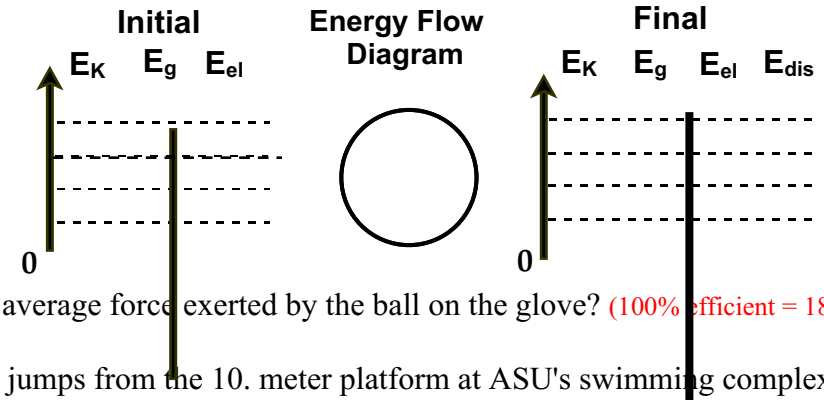
Name_____

Unit VII: Worksheet 4

Start each solution with a force diagram.

1. A baseball (m = 140 g) traveling at 30. m/s moves a fielder's glove backward 35 cm when the ball is caught.
   a. Construct an energy bar graph of the situation, with the ball as the system.



   b. What was the average force exerted by the ball on the glove? (100% efficient = 180N, 75% = 135N)

2. A 60. kg student jumps from the 10. meter platform at ASU's swimming complex into the pool below.
   a. Determine her E_g at the top of the platform. (6000J)

   $E_g = mgh = (60.kg)(10N/kg)(10.m) = 6000J$

   b. How much E_k does she possess at impact? (6000J)
   What is her velocity at impact? (v = 14.1 m/s)

   c. Repeat steps a and b for a 75 kg diver. (Eg & E_k =7500J) (v=14.1m/s)

   d. If she jumped from a platform that was twice as high, how many times greater would be her velocity at impact (compare to 60 kg woman)? (v = 20.0m/s)

   e. How much higher would the platform have to be in order for her velocity to be twice as great (compare to 60 kg woman at 10.m height)? (h= 39.8m)

3. A spring whose spring constant is 850 N/m is compressed 0.40 m. What is the maximum speed it can give to a 500. g ball? (16.5m/s)

4. If the spring in #3 were compressed twice as much, how many times greater would the velocity of the ball be? (approximately 2x or roughly 33 m/s)

5. A bullet with a mass of 10. g is fired from a rifle with a barrel that is 85 cm long.
   a. Assuming that the force exerted by the expanding gas to be a constant 5500 N, what speed would the bullet reach? (v=967m/s)

   b. Do an energy pie chart analysis of the situation, with the entire gun and bullet as the system.

6. A 24 kg child descends a 5.0 m high slide and reaches the ground with a speed of 2.8 m/s.
   a. How much energy was dissipated due to friction in the process? (Ediss = 1106J)

   b. Do a pie chart analysis of this situtation, using an accurate % of the pie to represent the amount of E_{diss} in the process.

7. Remember the Wyle Coyote shot from cannon problems? Suppose a scrawny 20. kg Wyle was shot straight up with an initial velocity of +50 m/s.
   a. Assuming that all his initial E_k was transformed into E_g, what is the maximum height he could reach? (h= 125m)

b. Suppose that 20% of his initial E_k were lost due to friction with the air (air resistance). What is the maximum height he could reach? (h=100m)